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Ultrasonic Environment Mapping Device

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Abstract

Now-a-days with the advancement of technology the world expects a lifelike virtual representation of problems that can be solved not by complicated calculations and computations but by simple clicks and movement of the hand and by quick trial and error methods to simulate a result or solution. Such methods are not efficient and economical if done practically. Computer simulations help give a visual taste of such problems and make it easier for us the image of the problem rather than trying to picture it in our minds.

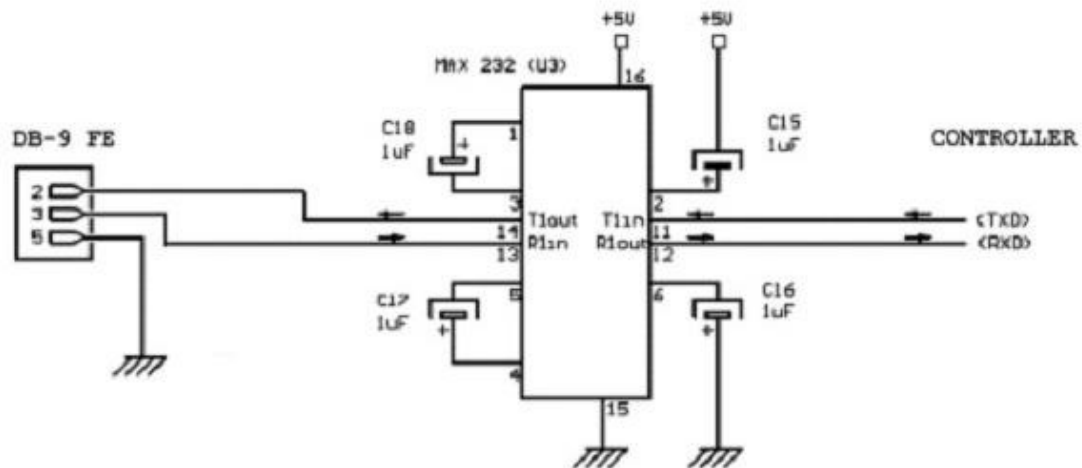
The **Ultrasonic Environment Mapping Device** tries to achieve this by simulating a plot of the object, room or environment it is placed in. As the name suggests, the UEMD uses a servomechanism to scan its surroundings by generating ultrasonic sound waves at set frequencies, receiving them after reflection and computing the distance using the simple relation between time, distance and velocity. It then sends this data to the computer which generates a plot of the environment it has scanned thus finally giving a virtual picture of the environment. Thus UEMD can be used everywhere where graphical representation of any unknown region is needed. With high precision and resolution it can be even used to obtain a blueprint of an area. In the field of animation a 3D vector mesh is required to create to make high definition and realistic shapes. UEMD can help in such processes. The device can be exploited extensively in the field of robotics where the

sensing the distance precisely and accurately is always a daunting task. UEMD can be of great help here too as it not only senses distance accurately and precisely but also in the entire surrounding area in just a couple of seconds.

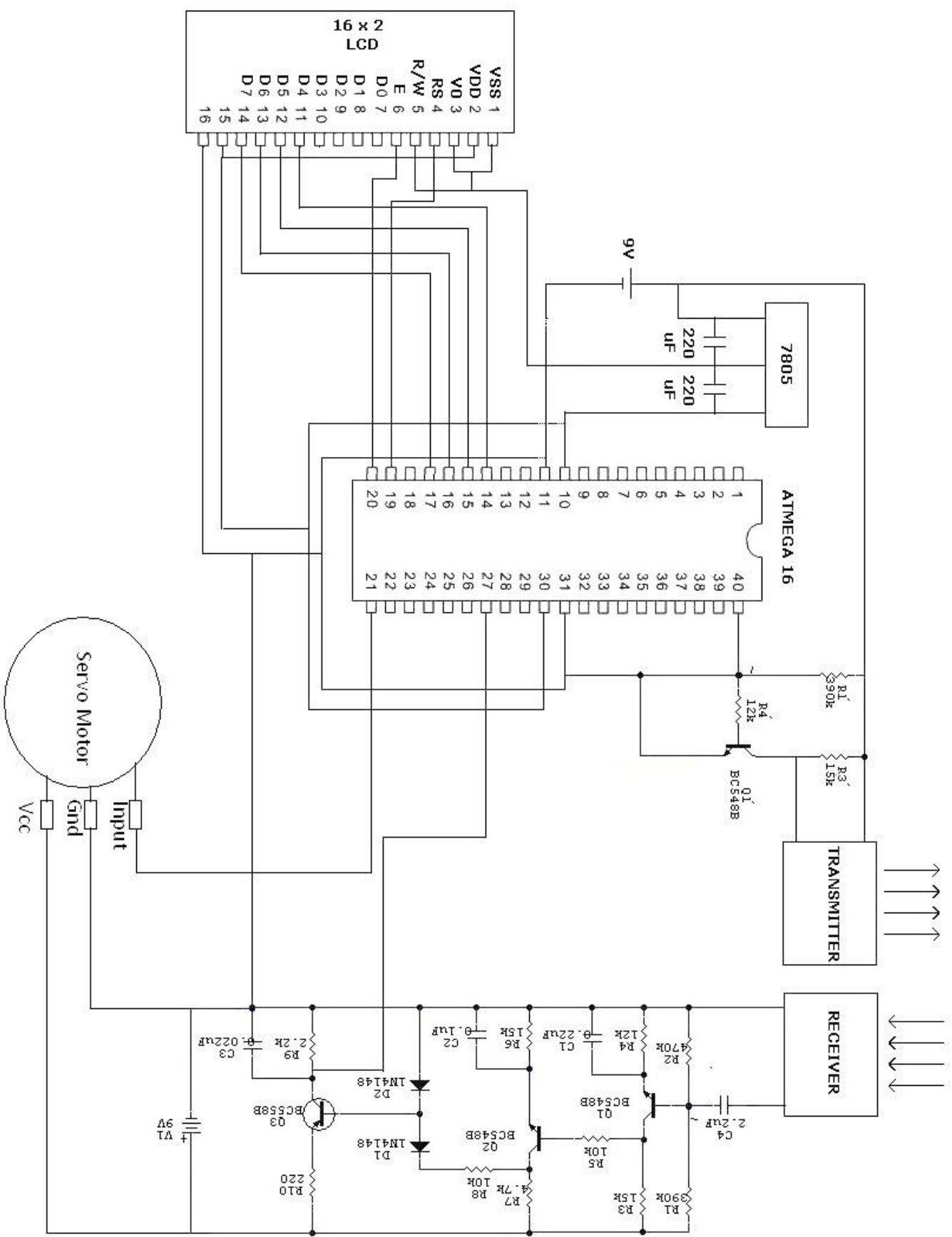
ATMEGA16 microcontroller is the heart of this project. A pair of ultrasonic sensors is used as transducers which are driven by square waves of 40KHz after proper current amplification. These transducers convert these electric signals into ultrasonic waves and send them to the targeted object, which is followed by the initializing of a counter in the microcontroller and incrementing of its value. These waves are received back after reflection from the target and interrupt the counter. But the waves, due to reflection, aren't strong enough to generate voltage needed for interrupting the controller. Hence an amplification circuit is designed which can amplify the transduced voltage to the necessary level. The interrupted counter, which now has a certain value according to the distance, serves as a reference for that distance and the device is calibrated accordingly to calculate the distance in cm as well as inches. The calculated distance is sent to the computer through serial port using RS232 protocol. The data sent to the computer is read with the help of a C program and, using graphics in C, the plot is plotted. This is what happens for a single point. The entire scanning of the object / environment is done by repeating the procedure for different angles of orientation of the transducers. For this the transducers are placed on a servo motor which rotates them. As the servomotor is controlled by the same microcontroller, the distance for the corresponding angle is known and thus synchronism between the plotting in C with the real environment scanning is maintained.

The resolution of the obtained image is completely dependent on the step angle of the servo motor used while the speed and the range of the device is dependent on the microcontroller and transducers respectively. This particular device, UEMD, has the range of approximately 4m and has been programmed to plot 90 distance points in 90°

thus leading to a resolution of 1° per reading. And with this resolution UEMD is capable of scanning 90° in less than 2 seconds.



Circuit Diagram 2: Interface between controller and computer using serial communication



Circuit Diagram 1: Main Circuit